

PICTORIAL BOOKLET

**Infrastructure Advisory &
Project Development Wing**

- Global Best Practices
- Resilient Structures
- Recommended Construction Methodologies



Pak Infra Zonation

Zone A : High Mountains

- GB, Kashmir, KP
- North Balochistan

- Earthquakes
- Glaciers, Landslides
- GLOF, Floods
- Dams, Tourism

Zone B : Urban, Rivers

- Central Punjab
- South Sindh

- Urban disasters
- Floods, Drainage
- Infra crisis

Zone D : Arid & Coastal

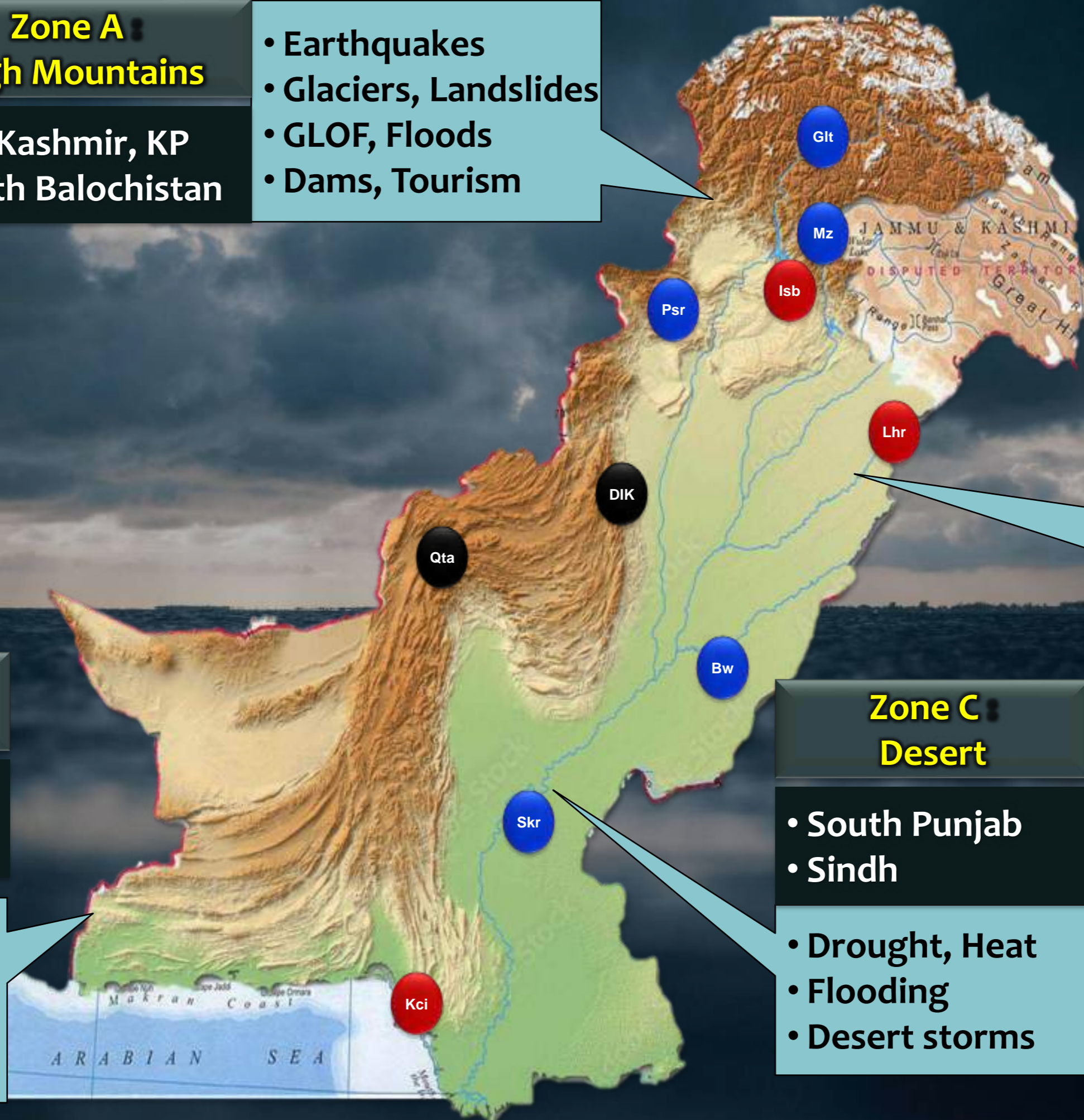
- Central Balochistan
- Coastal areas

- Tsunami, Volcanos
- Coastal Eruptions
- Locusts, Drought
- Fires, Minerals

Zone C : Desert

- South Punjab
- Sindh

- Drought, Heat
- Flooding
- Desert storms



National Emergency Operations Center



- Established in October 2023, National Emergency Operation Center is a pioneering initiative of the National Disaster Management Authority of Pakistan.
- Focused with a strategic vision to shift from reactive to proactive disaster management.
- NEOC is as a beacon of innovation and preparedness with the capability to anticipate disasters well in advance.

Infrastructure Advisory & Project Development

“The best way to predict the future is to create it”

Goals

Enhanced Resilience



Incorporate Adaptability



Smart Design Principle



Disaster Risk Reduction



Reasons behind weak Infrastructure

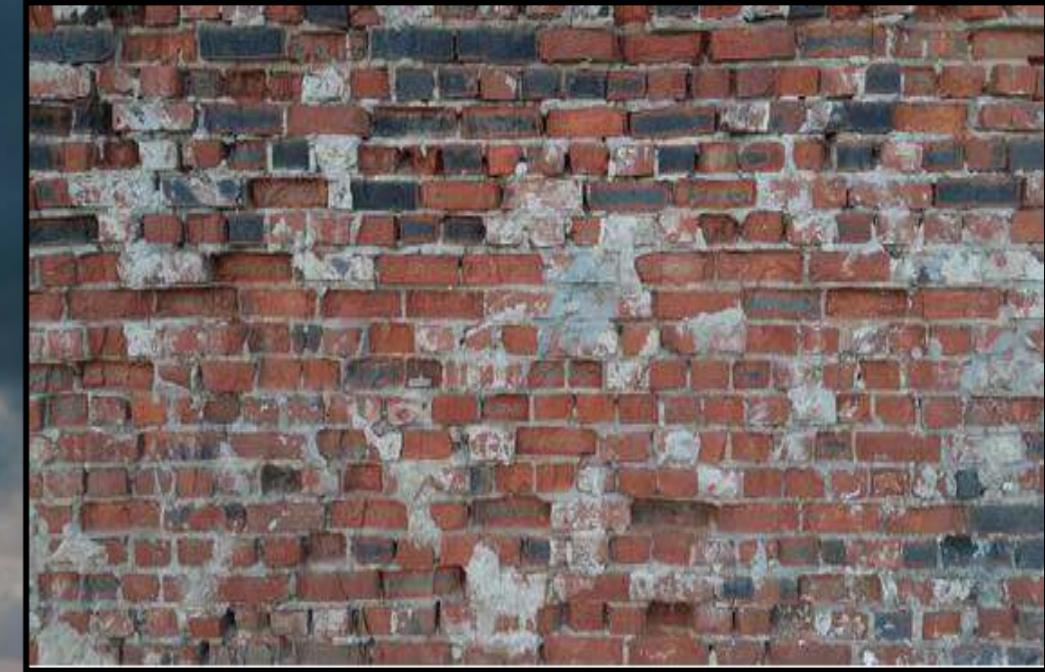
Non-observance of construction and safety codes



Negligence of bylaws



Use of Sub-standard construction materials



Absence of Infrastructure audit mechanism



Exclusion of architects & engineers

Lessons Learnt from Past Floods

Lack of Coordination between Stakeholders



Lack of Evacuation Plans/Sites



Lack of Land Use Planning



No Mechanism of Infrastructure Audit



Lack of Investment in resilient Infrastructure

Need for Booklet - Pakistan



Poor Socio – Economic Conditions



Population Growth



Multiple Stakeholders and Lack of Skilled Labor



Conventional Construction Practices are not Disaster Resilient

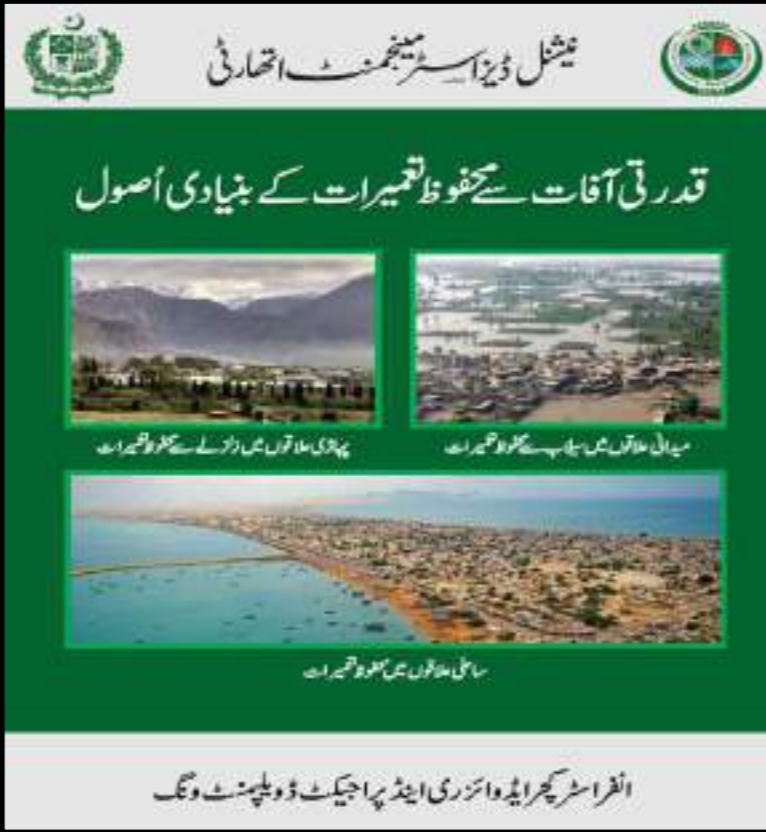
Pre-Disaster Scope



Audit / monitoring of existing Infrastructure



Strengthening & retrofitting measures



Templates for resilient constructions



Establishment of material hub

Post-Disaster Scope



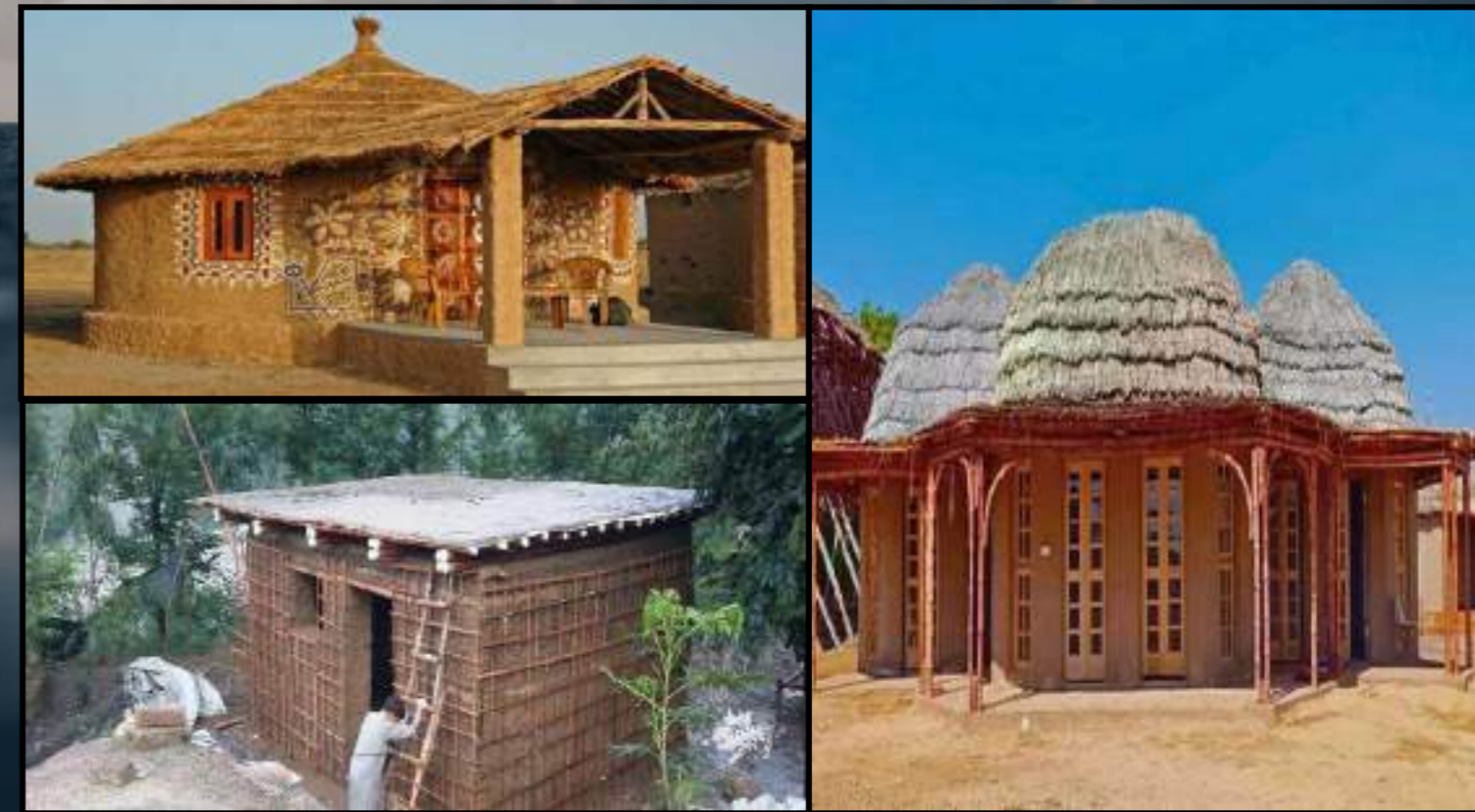
Prioritize rehabilitation & reconstruction projects



Build back better infra with affordable resilience



Course corrections measures for new construction



Promoting use of local materials & engaging local manpower

Zone A- Mountains

Zone A : High Mountains

- GB, Kashmir, KPK
- North Balochistan

- Earthquakes
- Glaciers, Landslides
- GLOF, Floods
- Dams, Tourism



Conventional Construction Practices



RCC

MERITS

- Earthquake Resilient
- Thermal Insulation
- Design Flexibility
- Durable
- Minimum Maintenance

DEMERITS

- High Cost
- Skilled Labor req
- Slow Const Speed



Confined Masonry

MERITS

- Earthquake Resilient
- Thermal Insulation
- Minimum Maintenance
- Durable

DEMERITS

- High Cost
- Skilled Labor req
- Slow Const Speed



Stone/Rock

MERITS

- Earthquake Resilient
- Renewable Resource
- Thermal Insulation

DEMERITS

- Slow Const Speed
- Skilled Labor Req
- Maintenance Cost



Wooden

MERITS

- Earthquake Resilient
- Thermal Insulation
- Renewable Resource

DEMERITS

- Fire Hazard
- Termite Infestation
- Deforestation
- Maintenance Cost
- Limited Durability

Zone A- Mountains

Infrastructure Recommendations

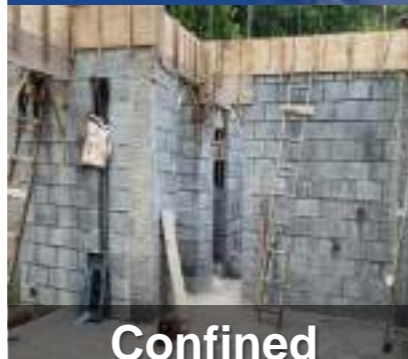
Existing Structures

Recommendations

Residential



Poor Construction Practices



Confined Masonry



Improved Stone Construction

Industries



Deteriorated Structures



Pre-Engineered Buildings (PEB)

Communication



Exposed to Land Sliding



Slope Stabilized Roads

Existing Structures

Recommendations

Commercial



Congested Structures



Moment Resisting Frame RCC

Hydraulic



Natural Reservoirs

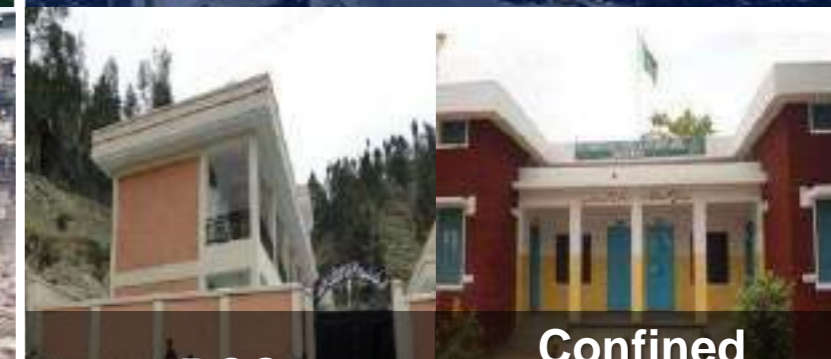


Small local dams and turbines

Public



Weak & Shaky Structures



RCC

Confined Masonry



Steel



Lumber / Wood



Pre-Fab and Pre-Cast



Cement & Stone

Existing



- Traditional stone construction
- Poor load distribution
- Increased maintenance cost



- Traditional wooden construction
- Resilient to earthquakes
- Less termite and fire resistance



- Mud / Clay as binding material
- Low resilience against earthquakes & floods

Recommendation



- Reinforced with timber
- Enhanced resilience
- Locally available material



- Reduced loading
- More resilient to floods, earthquakes & fires



- Cement added as binding material
- Wire mesh reinforcement

Zone A- Mountains

Global Best Practices compatible for Pakistan

NEPAL



Improved masonry



Timber laced masonry



Wooden construction



Vernacular construction

JAPAN



Base isolation



Dampers



Wooden construction

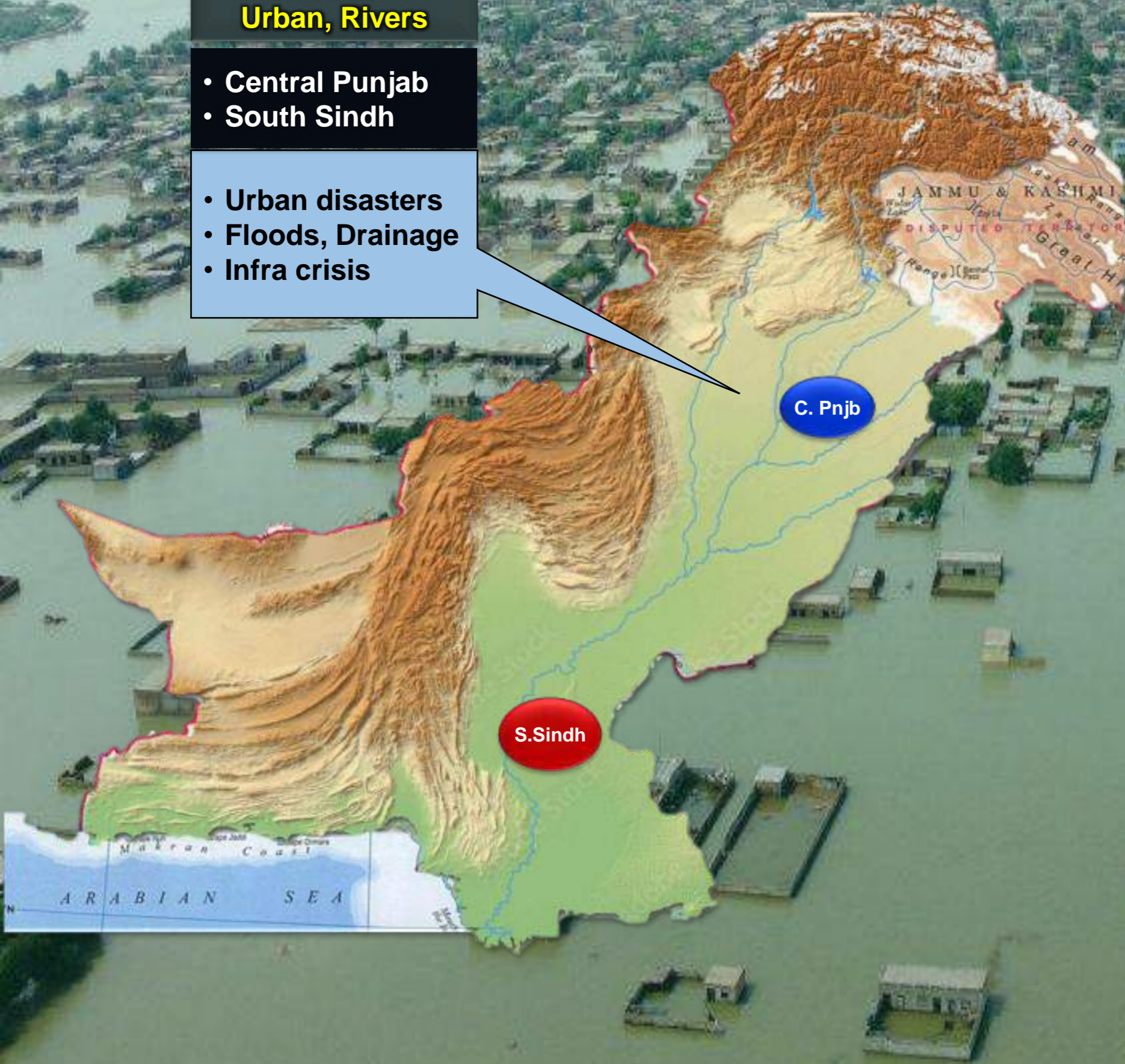


Pre-fab construction

Zone B – Urban Plains

Zone B : Urban, Rivers

- Central Punjab
 - South Sindh
-
- Urban disasters
 - Floods, Drainage
 - Infra crisis



Conventional Construction Practices



Pre-Cast Concrete

MERITS	DEMERITS
Rapid Const Speed	High Cost
Thermal Insulation	Skilled Labor req
Minimum Maint	
Durable	



Bamboo / Wood

MERITS	DEMERITS
Earthquake Resilient	Fire Hazard
Renewable Resource	Limited Durability
Low Cost	Pest Infestation
Rapid Const Speed	High Maint



Fire-Bricks

MERITS	DEMERITS
Thermal Insulation	Slow Const Speed
Minimum Maint	Skilled Labor Req
Durable	Relatively High Cost



Mud / Adobe

MERITS	DEMERITS
Low Cost	Vulnerable to Rain
Thermal Insulation	Termite Infestation
Renewable Resource	High Maint
	Limited Durability

Zone B- Urban Plains

Infrastructure Recommendations

Existing Structures

Recommendations

Residential



Industries



Communication



Existing Structures

Recommendations

Commercial



Hydraulic



Public



Zone B- Urban Plains

Recommended Construction Material



Rammed Earth Bricks

Treated Bamboo



Precast Panels/Slabs



Concrete & Steel

Existing



- Wooden/Bamboo construction
- Low resilience to floods



- Untreated Steel in RCC
- High Rise RCC Buildings

Recommendation



- Elevated construction
- High resilience to floods



- Provision of shear walls
- Providing horizontal reinforcement
- Increased resilience

Zone B- Urban Plains

Global Best Practices compatible for Pakistan

JAPAN



Underground reservoir



Improved drainage system

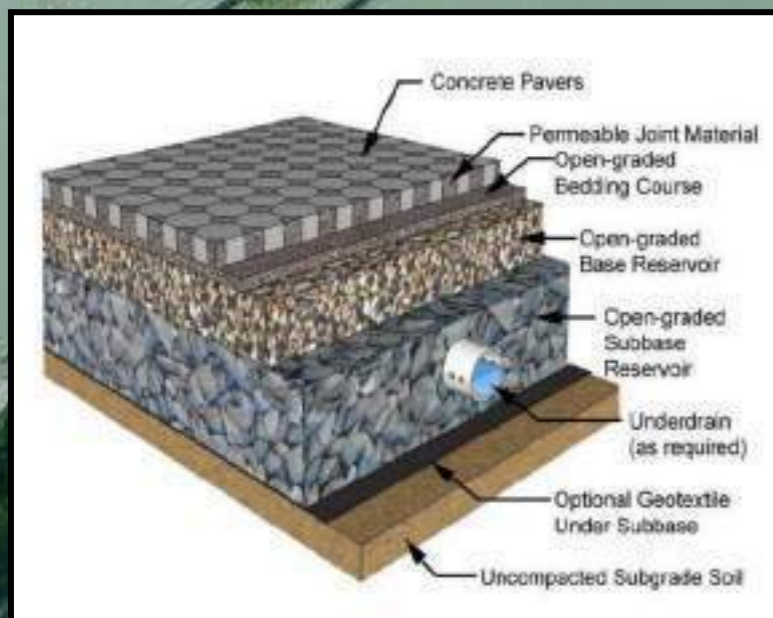


Seawall



Improved Embankment

USA



Permeable pavements



Rain gardens



Detention basins



Galveston Seawall

Zone B- Urban Plains

Global Best Practices compatible for Pakistan

BANGLADESH



Elevated houses



Multipurpose shelters



Clustered plinth



Sea walls & Embankments

AUSTRALIA



Green roofs



Flood gauges

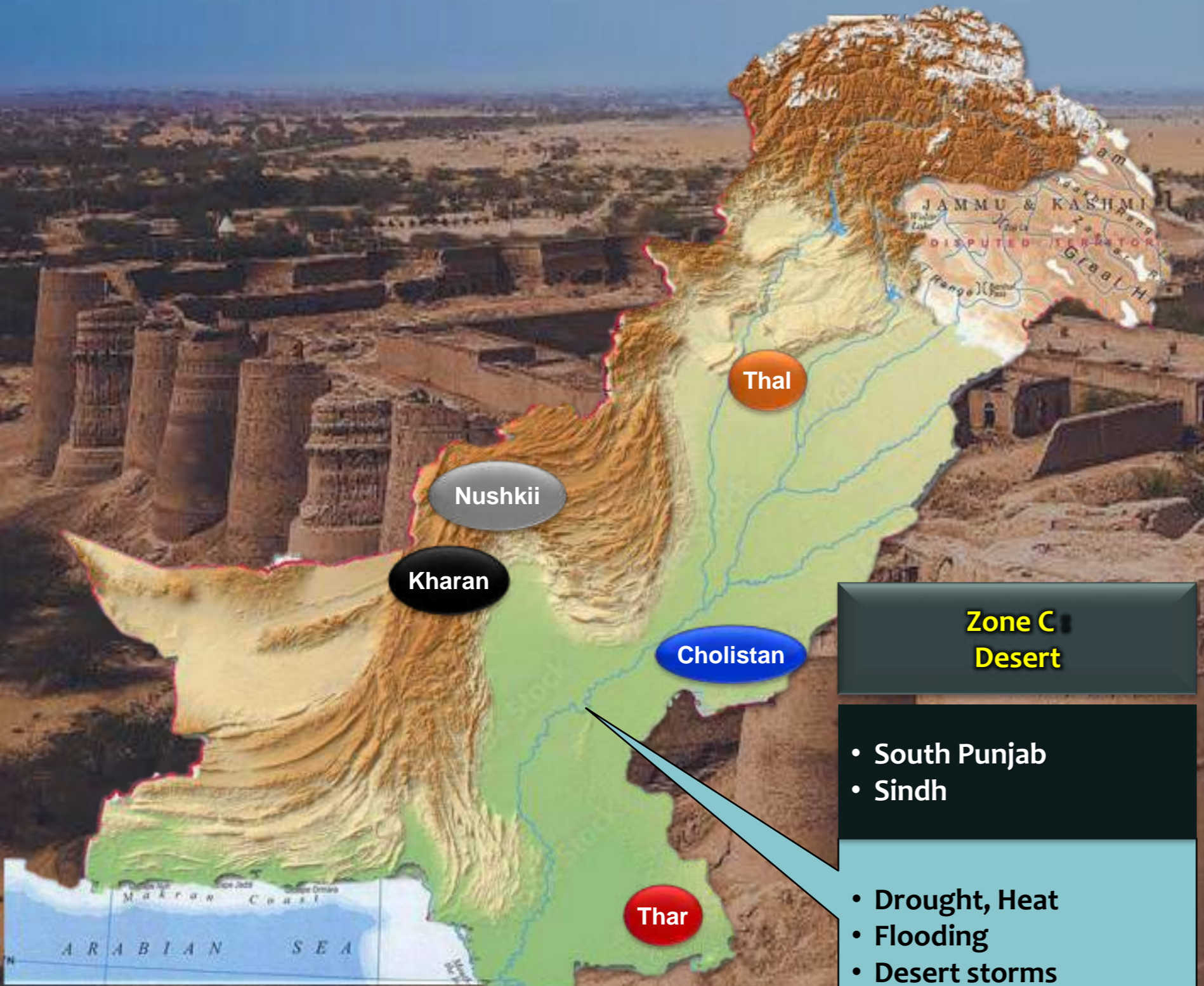


Levees



Coastal vegetation

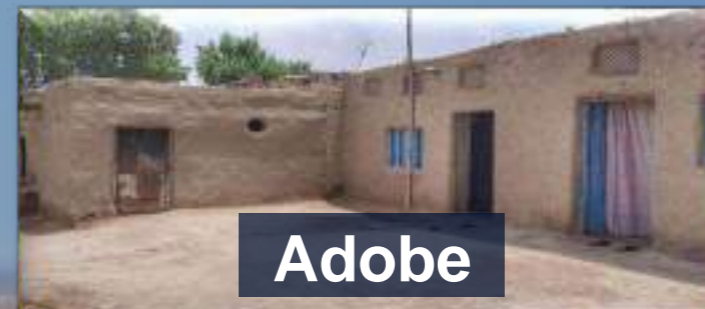
Zone C- Deserts



Zone C Desert

- South Punjab
- Sindh
- Drought, Heat
- Flooding
- Desert storms

Conventional Construction Practices



Adobe

MERITS	DEMERITS
Low Cost	High Maintenance
Eco-Friendly	Vulnerable to rain
Thermal Insulation	Limited Durability
Renewable Resources	



Wattle and Daub

MERITS	DEMERITS
Renewable Resources	High Maintenance
Thermal Insulation	Less Durable
Low Cost	Vulnerable to Pests



Brick Masonry

MERITS	DEMERITS
Earthquake Resilient	High Cost
Minimum Maintenance	Skilled Labor Req
Thermal Insulation	Slow Const Speed
Durable	



Block Masonry

MERITS	DEMERITS
Earthquake Resilient	High Cost
Thermal Insulation	Skilled Labor Req.
Minimum Maintenance	Slow Const Speed
Durable	

Existing Structures

Recommendations

Residential



Weak Structures



Improved Adobe Structures

Existing Structures

Recommendations

Commercial



Soil Erosion



Structural Bracing

Public

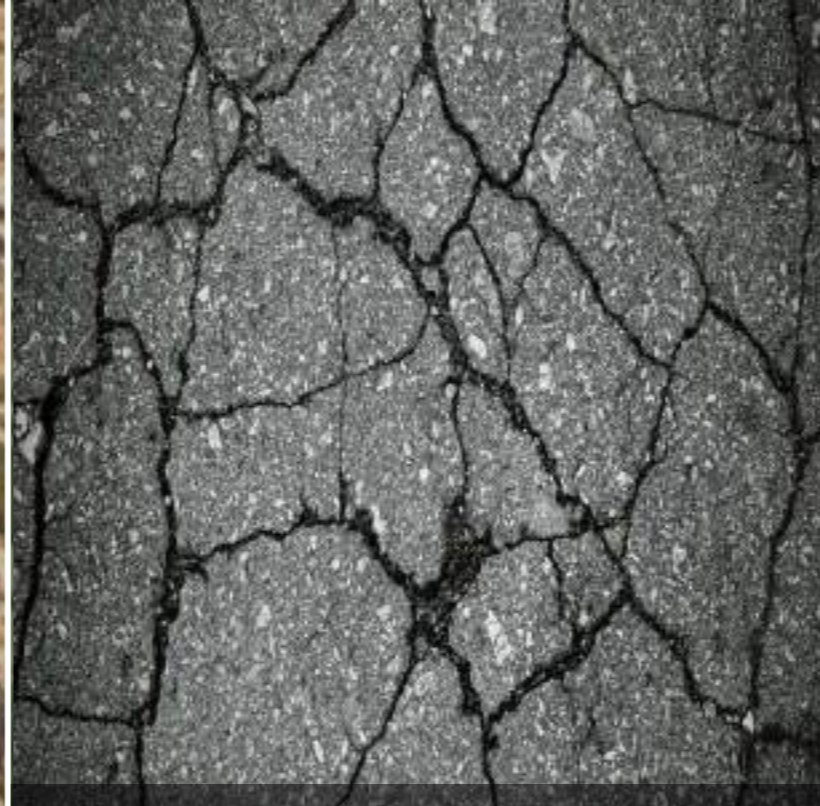


Heat Stress and Material Fatigue



Use of Modern Construction Tech

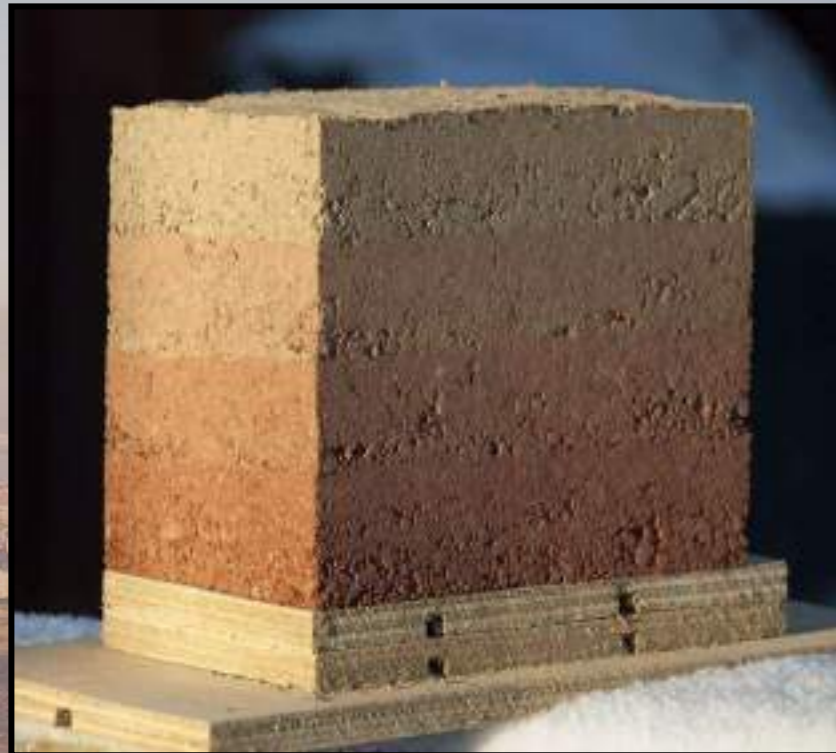
Communication



Thermal Cracking



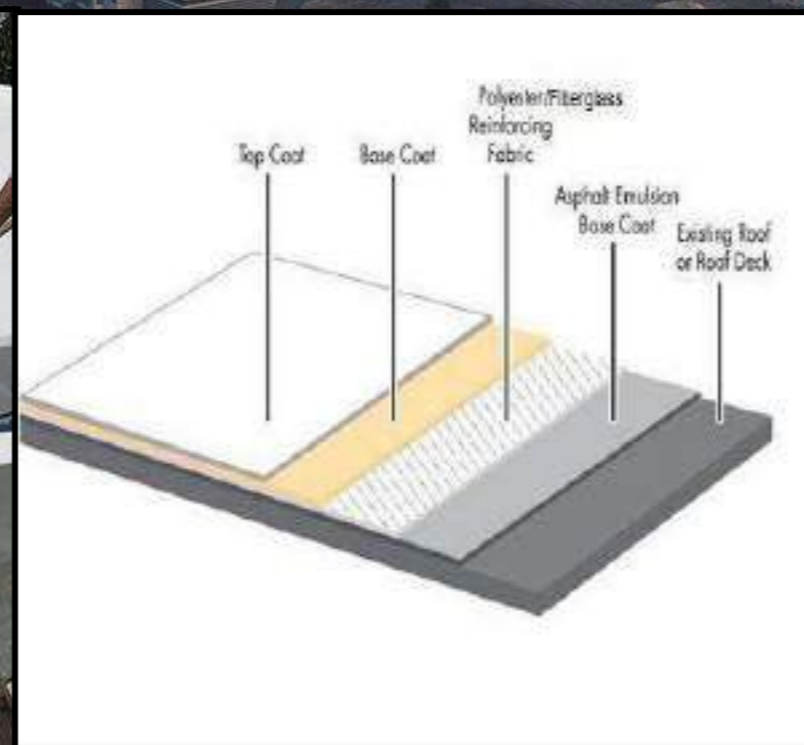
Use of High-Quality Materials



Rammed Earth

Cob Earth Blocks

- Locally sourced
- Eco-friendly
- Sustainable construction material
- Labor-intensive



Reflective Membranes and Coatings

Existing



Single Roof system



Poorly constructed Adobe Houses



Non-Insulated Roofs

Recommendation



Double Roof Design



Compressed Earth Blocks



Insulating Roofs & Walls

Zone C - Deserts

Global Best Practices compatible for Pakistan

Libya



Built wall-to-wall on 3 sides, Double circulation system



Ghadamesi Construction



High parapets, Double circulation sys

India



Solar Panels installed, Constructed by local craftsmen



Rajkumari Ratnavati Girls' School

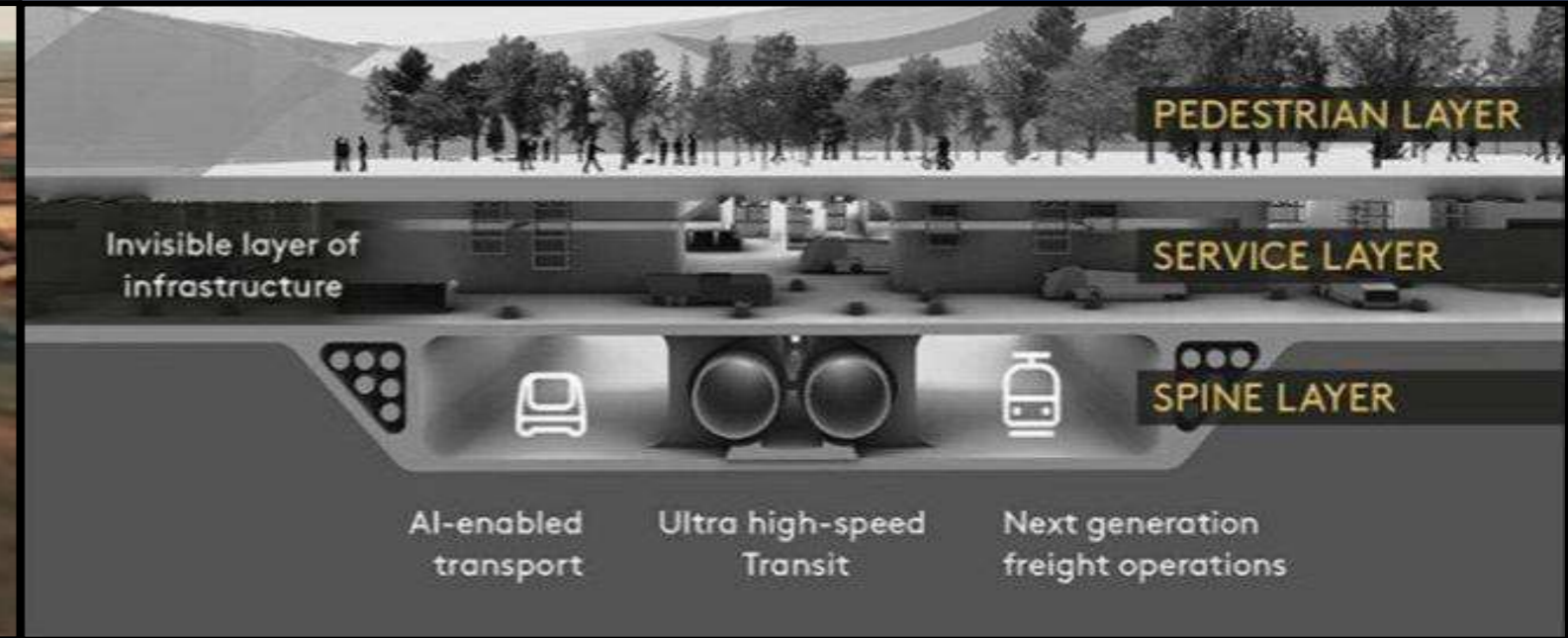


Optimized Building orientation, Structure's elliptical shape

Zone C - Deserts

Global Best Practices compatible for Pakistan

Saudi Arabia

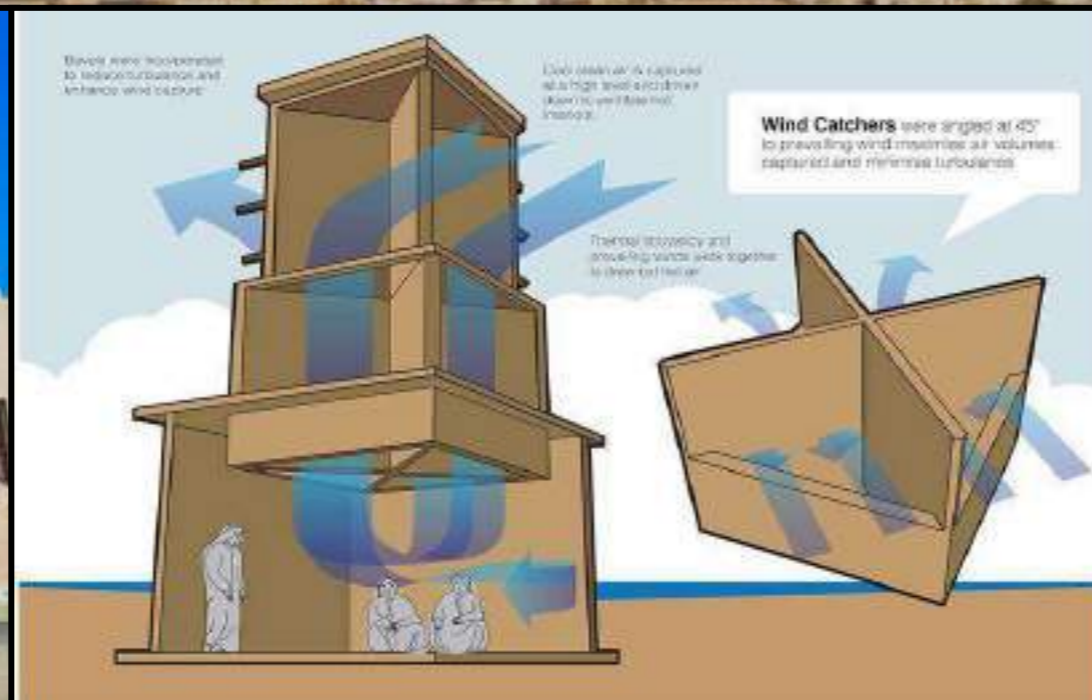


Zero-Carbon Design

The Line (NEOM)

Vertical Urbanism, Walkability

UAE



Wind Towers

Lightweight Modular Homes

Zone D - Coastal

Zone D : Arid & Coastal

- Central Balochistan
- Coastal areas

- Tsunami, Volcanos
- Coastal Eruptions
- Locusts, Drought
- Fires, Minerals



Conventional Construction Practices



Mud / Adobe

MERITS	DEMERITS
Renewable Resource	Maintenance Cost
Thermal Insulation	Build Codes Non-Comply
Cost Effective	Earthquake Prone
Fire Resist	Flood Prone



Stone Masonry

MERITS	DEMERITS
Earthquake Resilient	Slow Const Speed
Renewable Resource	Skilled Labor Req
Thermal Insulation	Maintenance Cost



Concrete Block Masonry

MERITS	DEMERITS
Earthquake Resilient	High Cost
Thermal Insulation	Skilled Labor req
Design Flexibility	Slow Const Speed
Durable	
Minimum Maintenance	



Brick Masonry

MERITS	DEMERITS
Earthquake Resilient	High Cost
Thermal Insulation	Skilled Labor req
Minimum Maintenance	Slow Const Speed
Durable	

Zone D - Coastal

Infrastructure Recommendations

Existing Structures

Recommendations

Residential



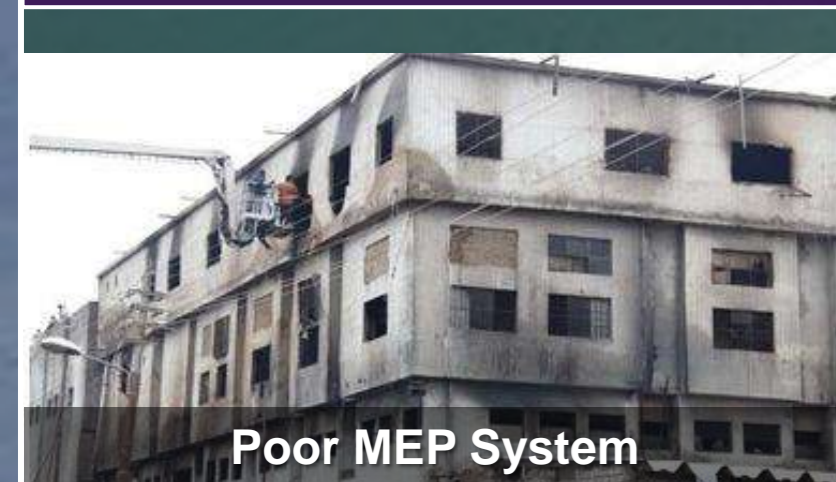
Weak Structures



Elevated

Pre-Cast

Industries



Poor MEP System



Proper MEP Design

Communication



Poor Road Drainage



Proper Drainage System

Existing Structures

Recommendations

Commercial



Vulnerable High Rise Structure



Structural Bracing

Hydraulic



Coastal Flooding



Embankment

Breakwater

Public



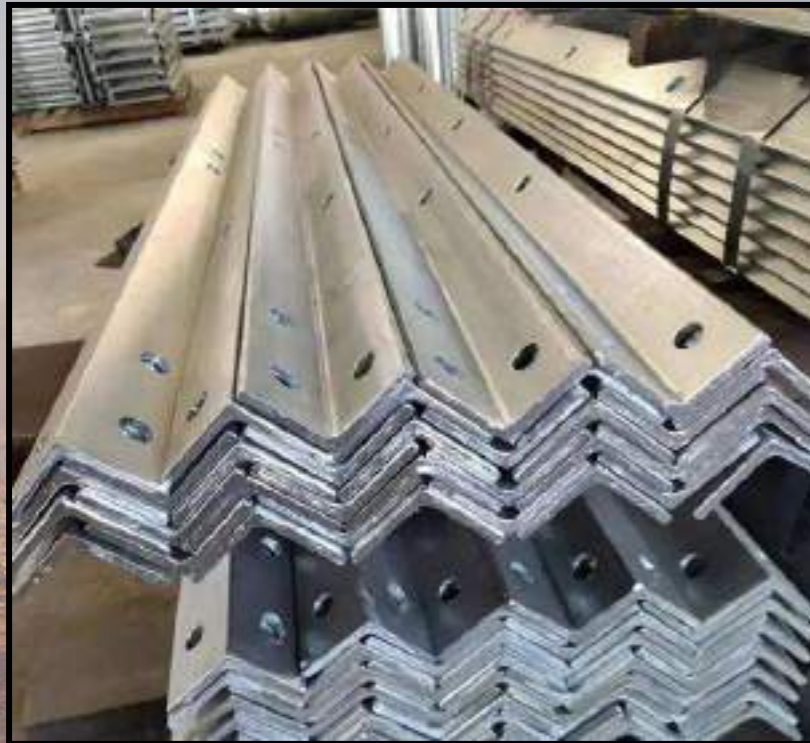
Old structures



Multi-Purpose Buildings

Zone D - Coastal

Recommended Construction Material



Galvanized Steel



Treated Lumber



Waterproof Coatings



Sulphate Resistant RCC

Zone D - Coastal

Recommended Construction Methodologies

Existing



- Poor embankment protection
- Soil erosion
- Increased maintenance cost



- Normal iron frame
- More prone to rust



- Mud / Clay as binding material
- Low earthquake & flood resilience

Recommendation



- Improved embankment
- Use of local material(stone pitching)



- Galvanized steel frame
- Resistant to rust action



- Bitumen coated walls
- Resistant to water ingress

Existing



- Coastal houses
- Prone to wind damage



- Normal concrete in marine structures
- Prone to sulphate attack

Recommendation



- Diagonally braced houses
- Increased resilience to wind action



- Sulphate resistant concrete
- Enhanced durability and resilience

USA



Galvanized steel frames



Water proofing



Pressure treated lumber



Wind resistant glazing

JAPAN



Breakwaters



Seawalls



Sea dikes



Underground Flood channels



National Disaster Management Authority - Pakistan

http://www.ndma.gov.pk/infra_advisory